DRAFT

Converting distance learning networks to a high bandwidth, flexible infrastructure

A White Paper
by the Staff of the Nebraska Information Technology Commission
and the Collaborative Aggregation Partnership (CAP)

December 10, 2004
(Revised March 7, 2005)

Table of Contents

INTRODUCTION

The staff of the Nebraska Information Technology Commission and the members of the Collaborative Aggregation Partnership (CAP) have drafted this white paper in an attempt to communicate the history, challenges and future facing a majority of Nebraska's distance learning consortia as they approach the end of their distance learning contracts. This white paper will suggest an upgrade plan and sustainable networking topology that will rely upon cooperation among K-12 districts, ESUs, higher education partners, and selected agencies of the State of Nebraska. The goal of this project is to upgrade existing video and data circuits and connect them into a high bandwidth, wide area network that will allow for a variety of asynchronous and synchronous distance learning applications and other education-related services to be delivered to the state's public high schools and their ESU, informal education and higher education partners. Although this white paper primarily focuses on the interoperability needs of the high schools and colleges using JPEG and MPEG2 video compression technology, the statewide education network would eventually serve every school building, district, and college.

Key assumptions include:
- That upgrading all 180 JPEG sites to H.264 video within a finite length of time (July 2006-August 2008), regardless of their original contract termination date, would be advantageous;

- That the capital investment for H.264 codecs and school/aggregation routing equipment comes from state, federal, or foundation funding sources and that the recurring revenue amount is roughly equivalent to the amount prior to conversion;

- That converting a commercial video data service (JPEG + T-1 data) to a high bandwidth (45Mbps or greater), flexible use network where the school or regional aggregation center would be responsible for their choice of applications and apportioned bandwidth would be advantageous;

- That maintaining the monthly recurring costs for the schools' flexible use, high bandwidth (45Mbps or greater) network services at a cost similar to the current statewide average ($1325/month--video + $216/month--T1 data = $1541/month) would be advantageous;

- That proliferating the IP videoconferencing applications to elementary schools and middle schools, and the ability to interconnect schools with higher education, health care, Internet2 entities outside Nebraska, and other state agencies would be advantageous;

- That preserving the existing programmatic relationships between schools already using video distance learning and to convert the infrastructure to a flexibly provisioned data network capable of serving emerging technology applications would be beneficial;

- That using Network Nebraska, the statewide multi-purpose telecommunications backbone, to the fullest extent possible; delivering Internet1, Internet2, streaming video, IP videoconferencing, and secure data transfer to participating entities and/or groups of participating entities would be beneficial;

- That the level and amount of involvement and intervention by selected state agencies and Network Nebraska to reach the solution described will largely be determined by the local

school districts, educational service units, distance learning consortia, and Legislature, upon mutual agreement by the affected state agencies.

BACKGROUND

Beginning in 1992, groups of Nebraska school districts began organizing themselves into eleven consortia for the purpose of delivering distance learning classes using interactive videoconferencing, mainly to high school classrooms. With the addition of one new consortium in 2002, 12 regional distance education consortia in Nebraska now provide video and data services to approximately 270 school districts. The number of school districts within each consortium ranges in number from six (6) to 72. The consortia combined local funds with state and federal grant funds to establish video distance learning, with an obligation to pay recurring costs over the life of 10-year contracts with telecommunications providers. The consortia are independent entities organized under inter-local agreements by participating school districts. Each has its own board of directors and distance learning director, acting as an executive officer. The distance learning directors' salaries are paid all, or in part, by the participating school districts or co-located Educational Service Unit.

The initial investment to build the distance education networks included about $17.5 million of state lottery funds and federal funding. The Legislature, as recently as 2001, appropriated an additional $3 million of state lottery funds to complete the system by adding another 44 school districts. Together, the 12 regional consortia spend over $3 million per year for video service contracts with providers. These costs average approximately $1325 per school district per month for the video service, ranging from $900 per month to $1800 per month.

Beginning with the fall semester of 2006 the original video service contracts for the distance learning consortia will start to expire. By August 2006, the contracts of the Southwest Nebraska Distance Learning Consortium and the Niobrara Valley TelePartnership will end, affecting 55 sites. Another seven distance learning consortia service contracts will expire through 2010, affecting 125 more sites. The 21 districts served with MPEG2 technology in the Crossroads Distance Education Consortium and Sandhills Technology Education Partnership already have ATM (asynchronous transfer mode) technology. An early technical assessment is that each of these 21 schools will need one codec card to upgrade their systems to compatibility with H.263/H.264 video technology. The 111 K-12 sites that have H.263/H.264 video over 100 Mbps cable-provided circuits are already upgraded. [See Appendix #3]

Currently, the 12 consortia utilize three different video technologies and are not able to provide interconnectivity between consortia. Nine telephone company-provided, JPEG consortia comprise 152 high schools and 28 ESU, higher education and informal education partners. All of these contracts for 45 Mbps (DS-3) circuits are due to expire between 2006 and 2010, with no replacement or upgrade funding models in place. Two telephone company-provided, MPEG2 consortia comprise 21 sites using 45 Mbps ATM infrastructure with contracts not due to expire until 2012. Each of these 21 sites will presumably need an H.264 codec card inserted into their video compression device to assure their interoperability with the other distance learning high schools. A cable company-provided consortium of 67 school districts in southeast Nebraska, 21

other cable-based schools near Kearney, and eight Lincoln Public Schools sites have already upgraded to H.263/H.264 video technology using 100Mbps or 1000Mbps full duplex circuits. Also, almost every school district with JPEG or MPEG2 video service and educational service units are purchasing from 1.5Mbps to 3.0Mbps of Internet access over these same circuits for an additional monthly charge.

The distance learning consortia offer a total of more than 600 classes per year, providing over 6,000 students and 2,300 adult learners with coursework including such subjects as foreign language, social sciences, mathematics, language arts, agriculture, and natural science. For rural Nebraska, especially, video distance learning is a key strategy for offsetting teacher shortages in certain subjects, offering advanced classes, and even providing elements of the core curriculum in order to maintain accreditation. The current distance learning systems concentrate on offering high school and college credit classes mainly to high school juniors and seniors, affecting nearly 10% of the students of this age group across the state, who opt to take video distance learning classes.

Distance learning holds even greater potential in the future with an integrated statewide system. A statewide synchronous video system would expand the opportunities for sharing classes among more schools across the State and allow much greater access to the instructional resources from higher education institutions. A statewide synchronous video system that is integrated with digital media and high bandwidth access to Internet1 and Internet2 would open up a wealth of educational resources across the state and from the nation and world. The flexible bandwidth of the resulting network would allow teachers to download digital video clips to supplement daily lessons, access streaming video, and conduct interactive videoconferencing with experts and scientists from across the globe with minimal prior planning. The teachers would also be able to participate in virtual field trips to distant sites (e.g. Smithsonian Institution, Mt. St. Helen's), gain access to web-based eLearning resources, and conduct videoconferences between groups of students from all over the United States. [See Appendix #1]

SWOC ANALYSIS

Strengths of the Existing Distance Learning Consortia Arrangement

The strengths most often associated with the existing distance learning consortia are:
- Fiber optic cable was installed from telecommunications service providers into a majority of the State's K-12 school districts;
- Commercial video/data service contracts and interlocal agreements were pioneered;
- Local funds, combined with state and federal grants, were procured to purchase and install distance learning equipment and infrastructure;
- High-quality video distance education has been delivered to schools on a reliable basis;
- Cooperation and interdependence are highly developed among participating school districts;
- Quality teaching resources have been shared with schools that would not otherwise be able to hire highly qualified teachers.

Weaknesses of the Existing Distance Learning Consortia Arrangement

The weaknesses most often associated with the existing distance learning consortia are:
- Course exchange is localized rather than regionalized or statewide, and prospective higher ed partners have some difficulty reaching schools within their service areas;
- The bartering or trading of classes between schools fails to incentivize larger, self-sufficient, or more progressive districts to offer synchronous or asynchronous learning opportunities;
- Most bell schedules and school calendars of schools involved in synchronous video instruction remain unsynchronized, thereby sacrificing precious instructional minutes;
- Several consortia boundaries and sizes do not correspond with any other political subdivision or management structure and fail to take advantage of economies of scale available through regionalization;
- In most consortia, existing technology fails to take full advantage of the bandwidth available to schools;
- Most consortia did not create a locally sustainable funding plan for upgrade and replacement at the outset of their original contract relationships.

Opportunities facing the Existing Distance Learning Consortia Arrangement

The opportunities most often associated with the future distance learning relationships are:
- The ability to develop regional education cooperatives that enable learners to accomplish seamless transfer between high school and college, and empowering administrators to procure all the educational opportunities needed within the cooperative;
- The ability to connect additional schools or groups of schools to Network Nebraska for intrastate and interstate connectivity as well as cost savings from lower priced Internet and access to Internet2;
- The ability to provide a common central scheduling or asset management software to streamline the process for reserving and activating video classrooms;
- The ability to enter into contracts that would provide flexible use of the existing bandwidth, capable of supporting multiple data services (including videoconferencing, streaming video, Internet1, Internet2 and other types of digital traffic) at the discretion of end users;
- The ability to regionalize future resource allocation, technical support, network management, and load balancing of Internet bandwidth [See Appendix #2];
- The ability to maximize the use of eLearning management software and digital media resources to augment synchronous video instruction.

Challenges facing the Existing Distance Learning Consortia Arrangement

The challenges most often associated with the present distance learning consortia are:
- Current JPEG technology in nine consortia serving 180 K-12 and higher education sites operates at a very high bandwidth, is obsolete and inefficient, and will likely suffer increased down time due to equipment failure before existing contracts expire;
- Providers have indicated that there may be major price increases when the existing 10-year video service contracts expire in the nine consortia using JPEG technology;
- Current network topology limits schools using JPEG or MPEG2 technology to just one class at a time, with only a very small capacity available for Internet1 and Internet2;

- Upgrading to new technology that makes more efficient use of network bandwidth involves considerable capital investment;
- Incompatible video technologies and the lack of interconnections among distance learning consortia limit the sharing of classes to those schools within each regional consortium;
- Spreading IP videoconferencing technology to more elementary and middle schools and allowing it to proliferate within high schools will involve building LAN upgrades as well as campus infrastructure upgrades.

STATEWIDE SYNCHRONOUS VIDEO NETWORK

Current Status

The NITC has been working on the concept of a statewide synchronous video network since 1999. In fact, part of the Legislature's concern that led to formation of the NITC was the choice of incompatible technologies in some of the distance learning consortia. Originally, this was a problem of analog vs. digital technologies. Now it is a problem of incompatible JPEG, MPEG2, and H.263/H.264 video protocols. Through the efforts of the NITC and its work groups, the following steps have been taken to move Nebraska closer to the vision of a statewide system:

- NITC Video Compression Standards, February 2002 (moved Nebraska from four video standards to two);
- NITC Video Compression Standards, September 2004 (moved Nebraska from two video standards to one);
- The Statewide Synchronous Video Work Group, composed of K-12, higher education, state agencies, telehealth, and informal education, has met five times to further the goal of interoperability through implementation of the NITC video standards and discussion of related upgrade issues;
- NITC Synchronous Video Network Strategic Initiative / Strategic Plan;
- Special request to Congressman Osborne to obtain $9.8 million for upgrade of the synchronous video network;
- NITC prioritization of the NDE Distance Learning: Infrastructure, Programming and Training Budget Request as one of five key I.T. projects to the Governor and Legislature;
- Facilitating the November 5, 2004 meeting with distance learning consortia directors and telecommunications vendors to discuss networking options;
- Development of this white paper to help describe the technology, implementation, and management of a high bandwidth, wide area network that will allow for a variety of asynchronous and synchronous distance learning applications and services to be delivered to numerous education entities; and
- Numerous meetings and briefings with involved entities to describe the elements of the project.

Currently (2-23-05), LB 689, sponsored by Senator Stuhr, with Education Committee Amendment 403 is on General File and due to be discussed on the floor of the Legislature. This bill:
- Creates the Distance Education Enhancement Task Force and names membership by 6/15/05:

- Chair of the Education Committee (chair of the Task Force)
- Chair of the Transportation and Telecommunications Committee
- Chair of the Appropriations Committee
- Two representatives from Educational Service Units
- Two representatives from distance education consortia
- One principal or superintendent
- One representative from the Nebraska Department of Education (infrastructure)
- One representative from the Nebraska Public Service Commission
- One representative from the Nebraska Information Technology Commission
- One representative from the Nebraska Educational Telecommunications Commission
- One representative from the coordinating commission for postsecondary education
- One representative from state colleges
- One representative from community colleges
- One representative from the University of Nebraska
- One representative of the Governor

- Requires a report by the Task Force by December 31, 2005 to include recommendations to:
  - develop broadband, scalable telecommunications structure for use in distance learning classrooms
  - develop an IP-based network to connect all existing and future distance learning and videoconferencing facilities
  - upgrade telecommunications equipment
  - provide training and support programs for educators in the development and use of distance learning
  - transfer distance education coordination responsibilities from distance education consortia to ESUs
  - provide for statewide coordination for distance education offerings
  - identify potential funding sources
  - establish an equitable and affordable financing system for equipment and usage
  - establishes a system that allows districts to purchase distance education offerings
  - establish statewide provision of other technology-based services
- Includes an intent to fund $10 million in FY 06, FY 07, FY 08

Future Options

Three options are being considered.

1) **Each consortium determines its** own upgrade path with no State assistance. The distance learning consortia are independent entities that can renegotiate their own rates, terms and conditions. If they comply with the NITC video standards, they would be able to establish connections to Network Nebraska or other consortia in the future in order to exchange classes or other content. The downside to this option is the risk that without aggregated or volume bidding, the overall costs may be greater than through a collective bargaining process that aggregates contracts. Another risk is that consortia will respond to higher rates by reducing the amount of bandwidth, which restricts the future potential uses of their networks. Individual school districts may respond to higher rates by reducing total bandwidth to the

next most affordable threshold (two or three T-1 data circuits; 3-4.5 Mbps). Full tariff networking costs, including technology upgrade for synchronous video, for the affected sites in the nine JPEG consortia have been estimated by providers to be $46 million over seven years of a new contract, as compared to $30 million over 10 years of the existing contracts. Existing sources of funding, such as federal e-rate monies and an average payment of $1541 per month from each high school, would cover some but not all of the $46 million, leaving an estimated $33 million in upfront costs for equipment and networking. Individual consortia would be free to apply for competitive USDA-RUS grants to help assist with each upgrade although each grant has a limit of $500,000. Without any decrease in projected costs through negotiated bids or any financial support from outside sources, the estimated monthly recurring costs (before E-Rate) on the $55 million project for each site would be $4,020/month for 84 months. [See Network Funding Scenario #1]

2) Establish a statewide contract with no State funding assistance. Consortia have discussed having Network Nebraska (Collaborative Aggregation Partnership) act as a prime contractor to assist them in negotiating a replacement topology and achieving better cost-savings on service contracts. This would presumably help to attain lower project costs and achieve an integrated, statewide system within a much shorter time frame. It could lead to additional connections to Network Nebraska and further aggregation of Internet purchasing. Yet, without outside funding such as a Congressional appropriation or additional lottery funds, neither the upfront nor the recurring costs would be affordable for many districts. This would further delay the infrastructure necessary to deliver the program elements of an essential Nebraska education. Besides non-participating schools, other excluded features would include scheduling software and transport costs to participate in Network Nebraska. Negotiation of a statewide contract would likely reduce the estimated network and synchronous video upgrade costs (over Option 1) to the affected schools but still could result in a recurring cost that is unaffordable to many schools. [See Network Funding Scenario #2]

3) Establish a statewide contract with additional funding for a statewide system. A central contract would lower costs through increased competition and access to technical expertise during contract negotiations. A central contract would provide a technical design that supports a statewide system and enables the service contracts of schools to be co-terminus for future funding upgrades and renegotiation purposes. Additional funding would help to keep overall costs affordable for all districts, create more flexibility for their existing bandwidth, and insure their participation in Network Nebraska. The estimated cost of this option is:
   - $9.3 million one-time costs to replace video codecs, add switches and routers to the school sites, and additional aggregation routers in each region;
   - An undetermined amount of upfront "buydown" costs that enable the 84-month, recurring costs to be affordable to participating schools;
   - Approximately $1.5 million per year ongoing costs to offset the Internet transport and backbone costs so that each school will have equitable access to Internet resources;
   - Approximately $2 million one-time costs to assist with critical local area network (LAN) upgrades for schools, on an as-needed basis;
   - Approximately $1.5 million to obtain a statewide scheduling/management system for synchronous video distance learning and videoconferencing;
   - Approximately $200,000 ongoing costs for training and support.

Option 3 contains all the advantages of Option 2 with additional upfront and ongoing support to make the network system affordable to the participating schools. [See Network Funding Scenario #3]

Recommended Approach

The third option of <u>Establishing a statewide contract with additional funding</u> is the only one that will insure a comprehensive, integrated, statewide system with the greatest number of schools involved.

Successful upgrade of the wide area network affecting 180 sites would ensure that technology could continue to play a major role in the delivery of educational services and content for the next seven years and beyond. As schools begin to exhaust the 45 Mbps bandwidth, new networking options could be explored and contracted at that point. Failure to upgrade would almost certainly "sentence" a great number of schools to the absolute minimum of Internet access, without the ability to access the software and data applications needed to deliver the essential elements of a Nebraska education.

RISK ASSESSMENT

The infrastructure upgrades described thus far in this white paper would replace the aging synchronous video technologies destined for contract expiration starting in 2006 and retrofit the present high bandwidth circuits for flexible data usage. The IP video technology upgrades and wide area, high bandwidth networking would greatly increase the number and variety of educational technology applications and Internet access available to schools. The resulting statewide education network would allow for statewide coordination of applications, more secure transport of data, and a more strategic approach to technical support and management. It is evident that some type of additional funding beyond local recurring contributions would be necessary to accomplish the network upgrade. If no funding becomes available, there are a variety of possible scenarios:

- School districts, unable to complete the high bandwidth circuit retrofit, would reduce their connectivity from 45 Mbps (DS-3 circuit) to 1.5 or 3.0 Mbps (one or two T-1 circuits) for the same monthly cost. They could eliminate their synchronous video exchange in favor of an Internet access of 1.5 or 3.0 Mbps (one or two T-1 circuits);
- School districts, unable to complete the high bandwidth circuit retrofit, would reduce their connectivity from 45 Mbps (DS-3 circuit) to 1.5 or 3.0 Mbps (one or two T-1 circuits) for the same monthly cost. Multipoint videoconferencing would decrease to 384 Kbps per channel and Internet access would be restricted to all or part of 1.5 Mbps (one T-1 circuit);
- School districts, either individually or as groups, could opt to increase their monthly recurring costs by 260% and apply for some grants to amortize the high bandwidth circuit retrofit and JPEG technology upgrades over 84 months. This scenario would have school districts or consortia of school districts contracting with telecommunication providers for services on a local basis. This increased monthly cost scenario would likely result in many

school districts either disconnecting or greatly reducing their telecommunications potential. It would also greatly delay the goal of establishing a statewide network that allows for a variety of asynchronous and synchronous distance learning applications and other education-related services to be delivered to the state's public high schools and their ESU, informal education and higher education partners.

NETWORK UPGRADE PLAN

The Network Upgrade Plan includes a proposed timeline of events, a discussion of the roles of the involved entities, and a possible funding portfolio to accomplish the project.

Proposed Timeline of Events

1. December 10, 2004: The first draft of the white paper is distributed to affected entities.
2. December 10, 2004-February 18, 2005: Input and recommended revisions to this white paper are received from the distance learning consortia, ESU-NOC committee, higher education and informal education partners, and the Statewide Synchronous Video Network Work Group as well as from the consortium boards and member schools.
3. February 18-February 25, 2005: The staff of the NITC revise the white paper.
4. March 8, 2005: The NITC Technical Panel recommends the white paper as important background information to accomplishing a wide area, high bandwidth, flexibly provisioned network capable of delivering a number of services to Nebraska education entities.
5. March 15, 2005: The NITC recommends the white paper as important background material to the Distance Education Enhancement Task Force, if created by LB 689, as the members discuss the creation of a wide area, high bandwidth, flexibly provisioned network capable of delivering a number of services to Nebraska education entities.
5. March 15-June 3, 2005: LB 689 is monitored as it moves through the legislative process. Named agencies and organizations respond if asked for membership suggestions for the Distance Education Enhancement Task Force.

   ********** Timeline events 6-8 dependent upon passage of LB 689 **********

6. June 15-December 31, 2005: The Distance Education Enhancement Task Force meets to formulate recommendations to upgrade and coordinate distance education.
7. December 31, 2005: The Distance Education Enhancement Task Force submits its improvement plan to upgrade and coordinate distance education in Nebraska. The report shall include recommendations for policies and potential legislation to the Clerk of the Legislature.
8. January-April, 2006 Pending the recommendations of the Distance Education Enhancement Task Force, the Legislature considers additional funding support for the distance education enhancement project.

   ***** All remaining events and the accompanying timeline are purely hypothetical and are provided in an attempt to demonstrate the feasibility of the overall project *****

9. May, 2006: Pending the funding and policy recommendations of the Legislature, the DAS-Division of Communications, in partnership with CAP, ESUs, and distance learning consortia, construct and release an RFP and bid process that provides for a master purchasing contract for wide area, high bandwidth, flexibly provisioned network circuits to all affected entities.
10. Date Uncertain: Bids are awarded by DAS-Division of Communications for a master purchasing contract for 180 45 Mbps or greater tail circuits that will be activated from 2006-08.
11. November-December, 2005: First wave of school districts file e-Rate form 471s for "Telecommunications" from the Network Nebraska master contract, effective July 1, 2006.
12. May-August, 2006: The first wave of H.264 codecs, building routers, and aggregation routers are installed in K-12 and higher education sites, with DS-3 upgrades occurring from July 1-August 15, 2006.
13. July-August, 2006: Twenty-one H.264 cards are installed in the Mac500 codecs of the Sandhills Technology Education Partnership schools and the Crossroads Consortium schools.
14. November-December, 2006: Second wave of school districts file e-Rate form 471s for "Telecommunications" from the Network Nebraska master contract, effective July 1, 2007.
15. May-August, 2007: The second wave of H.264 codecs, building routers, and aggregation routers are installed in K-12 and higher education sites, with DS-3 upgrades occurring from July 1-August 15, 2007.
16. September 1, 2007: Over 300 education sites are united by a high bandwidth, wide area network, capable of point-to-point and point-to-multipoint IP videoconferencing, between schools and from schools to other entities.

Roles of the Involved Entities

The **Local Education Agency** (LEA) [e.g. school, ESU, college] is the end-user of the services and bandwidth available over the network. Currently, each school, ESU, or college maintains its own technical support staff. The level of support ranges from volunteer or stipended part time staff in smaller schools to multiple full-time staff in larger schools, ESUs and college campus network operations centers. Responsibilities of the LEA under the wide area, flexibly provisioned, high bandwidth network would include maintaining a secure Local Area Network (LAN) extending to the Ethernet port on the router, including but not limited to effective virus protection, current Operating Systems with updates on all devices, properly licensed software, uninterruptible power supplies, and device security. The LEA would also maintain its own videoconferencing and distance learning equipment or contract for maintenance on the equipment. The LEA would also own and maintain its building router using contracted vendor maintenance. The maintenance would include a current operating system, up-to-date access lists, appropriate reflective access lists, and redundancy of core devices to the extent possible. The LEAs would have representation on the Network Nebraska Advisory Group (NNAG).

The **Distance Learning Consortia** (DLC) directors currently function as schedulers, troubleshooters, eRate specialists, program developers, and the member schools' technical and contract liaisons to the telecommunication service providers. As the wide area network upgrade is phased in, DLC directors would be responsible for developing training materials on the new IP video technology for school district staff and teachers. DLC directors would also help: Develop specifications and guidelines for the provisioning of a statewide asset management system for monitoring of videoconferencing facilities; develop specifications and guidelines for a web-based event clearinghouse of educational programs and opportunities; and guide schools with the purchase and deployment of additional IP video devices. The DLC directors would become coordinators of digital content, operating as the programmatic representatives for area schools. The DLC directors would have representation on the Network Nebraska Advisory Group (NNAG).

The **Educational Service Unit—Regional Network Operations Centers** (ESU-RNOC), once established, would be the interfaces between the high bandwidth, wide area networks serving the LEAs and the Network Nebraska backbone. Currently, the ESU network operations staff individually assist with such services as e-mail, Internet filtering, network security, technical troubleshooting, and hardware and software applications. As the ESU-NROCs are established, the regional ESUs and colleges could opt to leverage existing staff expertise and hire new expertise to manage and maintain regional services. Although there would likely be some regional aggregation of servers and routers, these devices would be able to be managed remotely. The ESU-RNOCs would extend service contracts to LEAs to help manage their bandwidth and resolve issues related to Network Nebraska usage. The ESU-RNOCs would manage wide area network bandwidth usage/traffic within their regional aggregation. The ESU-RNOCs would manage/limit bandwidth usage/traffic when leaving the regional aggregations to traverse Network Nebraska. The ESU-RNOC would reserve the right to correct any network activity which compromises or potentially compromises the regional wide area network or Network Nebraska through insecure or illegal network use as well as non-educational or inappropriate network use. The ESU-RNOCs would provide consultation and support to LEAs as mutually agreed. The ESU-NROCs would assure compliance with all contractual terms and conditions related to access and transmission on Network Nebraska. The ESU-RNOCs would have representation on the Network Nebraska Advisory Group (NNAG).

The **University of Nebraska Computing Services Network** (UNCSN) would be the main contact between the ESU-NROCs and the service providers. The staff of the UNCSN would receive requests for service and convert them into service orders, helping to insure that the requirements of the customer are being met by the primary and secondary providers. The UNCSN would be the aggregator of Internet demand and purchaser of Internet service for the public entities who opt for this service through Network Nebraska. The UNCSN would also handle the routing of traffic to Internet2 among eligible entities. The UNCSN would staff the Level 2 Network Operations Center for education entities on Network Nebraska. The UNCSN would host the Network Nebraska website, www.networknebraska.net. The UNCSN would participate in the Network Nebraska Advisory Group (NNAG).

The **Department of Administrative Services—Division of Communications** (DAS-DOC) would be the main author of the Request for Proposal (RFP), with input and specifications

provided by the DLCs and ESUs. The DAS-DOC would negotiate the master purchase contract, allowing school districts and colleges or groups of school districts and colleges, to purchase services from the master purchasing contract. These services would include Internet access and/or transport from the major nodes (Norfolk, Omaha, Lincoln, Grand Island, Kearney, North Platte, Scottsbluff) of the statewide network and 45Mbps or greater transport through high bandwidth, wide area networking circuits on a regional basis. The DAS-DOC would charge an administrative fee to end users or groups of end users for use of its services. This administrative fee is regulated by the Federal government and must be the same fee charged to any DAS-DOC customer; local, state, or Federal. The administrative fee is currently set at 10% and includes the services of network management, network troubleshooting, network aggregation, consolidated billing, and contract negotiation. The DAS-DOC would participate in the Network Nebraska Advisory Group (NNAG).

Nebraska Educational Telecommunications (NET) would staff the Level 1 help desk and Network Information Center for Network Nebraska, answering the 1-888-NET-NEBR (888-638-6327) toll-free number. NET staff would assist with the master purchase of the building codec, switching and router equipment as well as consulting on room integration issues. NET would be a likely provider of digital content over the terrestrial and satellite transmitter network. NET would participate in the Network Nebraska Advisory Group (NNAG).

The **Nebraska Information Technology Commission** (NITC) would act as a facilitator of the process, providing staff assistance as needed to arrange and hold meetings, build consensus, draft documents, communicate with involved entities, and provide briefings to potential users, stakeholders, providers, and policy makers. The Legislature created the NITC to guide the State's investments in information technology. The NITC Technical Panel has recommended video compression protocol standards to accomplish a statewide synchronous videoconferencing network and can respond to subsequent requests for other networking standards. The NITC would provide staff support for, and participate in, the Network Nebraska Advisory Group (NNAG).

The **Nebraska Department of Education** (NDE) would offer policy and programmatic guidance to make sure that the resulting network capacity and videoconferencing system would be able to offer enough educational opportunities for schools to deliver the elements of an essential Nebraska education, as described by the State Board of Education. The NDE would take the State lead on helping to secure funding to make the project feasible. NDE would offer policy and funding guidance on matters related to E-Rate eligibility. The NDE would participate in the Network Nebraska Advisory Group (NNAG).

The **Nebraska Public Service Commission** (PSC) would offer policy guidance and consultation to make sure that the services and pricing offered by the telecommunications providers comply with the PSC telecommunications rules and regulations. The role of the PSC is to make sure that every available service and pricing alternative is being considered by the industry in order to improve the project affordability for Nebraska schools. The PSC would participate in the Network Nebraska Advisory Group (NNAG).

The **Network Nebraska Advisory Group** (NNAG) would provide the conduit for LEAs, DLC directors, and ESU-NROC staff to provide input to Network Nebraska and the members of the Collaborative Aggregation Partnership. Quarterly face-to-face or videoconferencing meetings would be held to discuss upcoming events, issues, and performance of the network. Membership would be open to any end-user or customer of Network Nebraska. The NITC would charter the Network Nebraska Advisory Group with a list of responsibilities and duties.

Funding Portfolio

Providing a feasible funding portfolio is a critically important piece of this project. However, many variables cannot be defined at this juncture. The actual and eventual costs of equipment and networking cannot be known without performing a bid process. So, scenarios can only be presented at this time based upon the industry's best estimates.

Notes: Site router and switches, H.263/H.264 codec and scheduling software are likely to be ineligible for E-Rate reimbursement unless included in a service product from telecommunications providers. If bid separately as equipment and software, these components would have to be paid for at the outset of the project or amortized over the life of the contract. Higher education and informal education partners are ineligible for E-Rate and state K-12 funding, therefore their upgrade costs must be taken into consideration.

The NDE budget adjustment document outlined project estimates for the equipment, maintenance, training, and management of the system. These numbers would vary considerably by the time of implementation, depending upon amortization and negotiation of a master purchase contract.
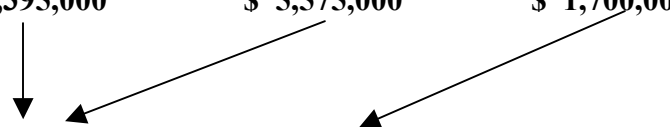
Sustainability

In most cases, the previous 10-year commercial video data service contracts of the DLCs failed to build in any escrow or funding to meet the future costs associated with equipment and technology upgrades at the culmination of the contracts. The next contracts for wide area, high bandwidth services must provide for some type of mechanism for funding technology upgrades at the end of the contract period.

Statewide Synchronous Video Network

Equipment Costs (as identified in the NDE Budget Adjustment request, 9-22-04)

Account Description by item	FY 06 Adj Req	FY 07 Adj Req	Est. Ongoing
School Site Router Hardware	$ 800,000	$ 800,000	$ 0
School Site Router Maintenance	$ 250,000	$ 250,000	$ 250,000
Aggregation Point Router Hardware	$ 1,300,000	$ 0	$ 0
Aggregation Router Maintenance	$ 200,000	$ 200,000	$ 200,000
School Site Codec Hardware	$ 1,500,000	$ 1,500,000	$ 0
School site Codec Maintenance	$ 200,000	$ 200,000	$ 200,000
Ancillary Equipment/LAN upgrades	$ 1,200,000	$ 1,700,000	$ 500,000
Scheduling/Management system	$ 745,000	$ 725,000	$ 350,000
Training and Support	$ 200,000	$ 200,000	$ 200,000
Subtotal	**$ 6,395,000**	**$ 5,575,000**	**$ 1,700,000**

Account Description by item	FY 06-07 Adj Req	Est. Ongoing	Responsibility
School Site Router Hardware	$ 1,600,000	$ 0	Outside Funds
School Site Router Maintenance	$ 500,000	$ 250,000	LEA
Aggregation Point Router Hardware	$ 1,300,000	$ 0	Outside Funds
Aggregation Router Maintenance	$ 400,000	$ 200,000	Network NE
School Site Codec Hardware	$ 3,000,000	$ 0	Outside Funds
School site Codec Maintenance	$ 400,000	$ 200,000	LEA
Ancillary Equipment/LAN upgrades	$ 2,900,000	$ 500,000	Outside Funds
Scheduling/Management system	$ 1,470,000	$ 350,000	Outside Funds
Training and Support	$ 400,000	$ 200,000	ESUs/DLC
Subtotal	**$11,970,000**	**$ 1,700,000**	

Account Description by Source	FY 06-07 Adj Req	Est. Ongoing
Outside Funds	$10,270,000	$ 850,000
Network Nebraska	$ 400,000	$ 200,000
Local Education Agencies	$ 900,000	$ 450,000 ($228/month/site)
ESUs/DLC Directors	$ 400,000	$ 200,000
Subtotal	**$11,970,000**	**$ 1,700,000**

Statewide Synchronous Video Network

Networking Costs (as estimated by telecommunications providers, September 2004)

Account Description by Service	Total Contract (7 yrs)
Qwest Network Price	$ 30,634,227
NIN Network Price	$ 15,400,000
Subtotal	**$ 46,034,227**

Network Funding Scenario #1 (assuming full estimated cost of network, $3342/month local contributions, no time value of money, with no buydown, and equipment paid for by others)

Account Description by Source	7yr Contract
Total Estimated Network Costs	$ 46,034,227
Est. Local Contribution Before E-Rate ($3342/mnth x 84 mnths x 164 sites) -	$ 46,034,227
Gap in Network Funding	$ 0

Network Funding Scenario #2 (assuming 20% discounted cost of network, $2673/month local contributions, no time value of money, with no buydown, and equipment paid for by others)

Account Description by Source	7yr Contract
Total Estimated Network Costs	$ 36,827,377
Est. Local Contribution Before E-Rate ($2673/mnth x 84 mnths x 164 sites) -	$ 36,827,377
Gap in Network Funding	$ 0

Network Funding Scenario #3 (assuming 20% discounted cost of network, $1541/month local contributions, leveraging time value of money, with buydown, and equipment paid for by others)

Account Description by Source	7yr Contract
Total Estimated Network Costs	$ 36,827,377
Est. Local Contribution Before E-Rate ($1541/mnth x 84 mnths x 164 sites) -	$ 21,228,816
Gap in Network Funding	$ 15,598,561
Credit for Time Value of Money (9% x 7 yrs = Future Value Factor of 1.8280)-	$ 7,065,431
Difference (Buydown)	$ 8,533,130

Difference (Buydown) would have to come from a combination of Local, State, and Federal sources.

Appendix 1

**45 megabit DS-3 fiber
(old JPEG and T-1 Internet)**

**45 megabit DS-3 fiber
(new Flexible Use)**

JPEG Video

Internet1

**NDE
Data**

Internet2

eLearning

Internet1

**IP
Video**

**IP
Video**

**IP
Video**
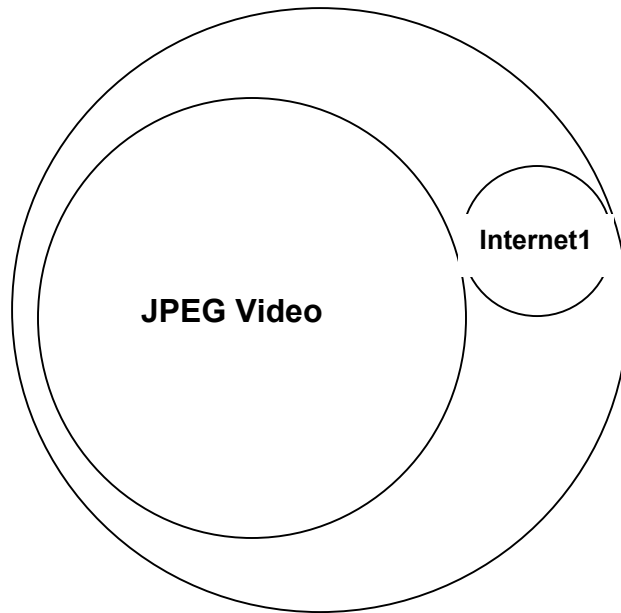
**Streaming
Video**

$1325/month JPEG video
$ 216/month T-1 Internet
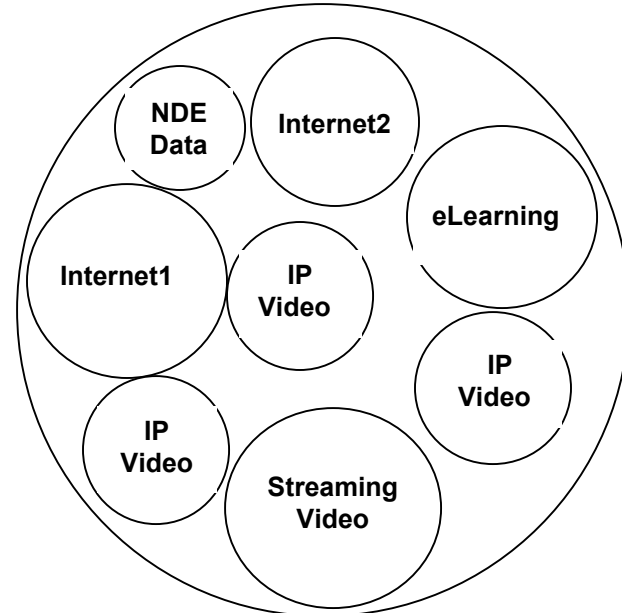
$1541/month full use of
fiber capacity for IP
Video, Internet1,
Internet2,
streaming video,
eLearning, NDE data

Technology Conversion for Nebraska Education Network
[Formerly the Distance Learning Network]
Nebraska's Telephone / Telecommunications Industry

Map Legend for Network
- Existing Fiber to Premise
- Indep Private Line DS-3
- Qwest Private Line DS-3

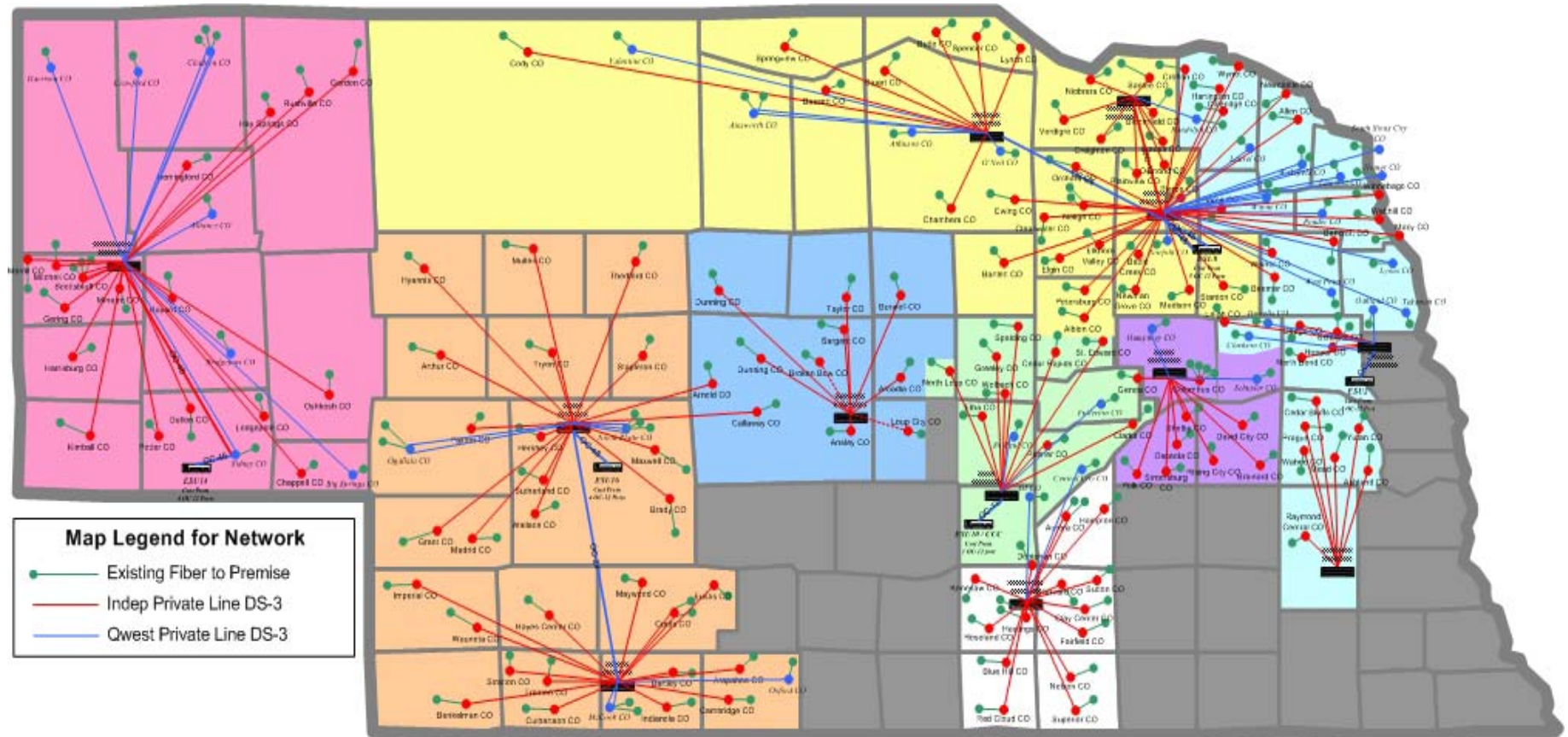| High School or Community-School/School	Bandwidth	Video Protocol	ESU Area	Dist. Learning Consortium	Contract Expires	Community College Area
Aurora	45 Mbps	JPEG	9	CNDEC	2008	Central CC
Aurora-Edgerton Explorit Center	45 Mbps	JPEG				Central CC
Blue Hill	45 Mbps	JPEG	9	CNDEC	2008	Central CC
Central City	45 Mbps	JPEG	7	CNDEC	2008	Central CC
Clay Center	45 Mbps	JPEG	9	CNDEC	2008	Central CC
Doniphan-Doniphan/Trumbull	45 Mbps	JPEG	9	CNDEC	2008	Central CC
Fairfield-South Central Unified 5	45 Mbps	JPEG	9	CNDEC	2008	Central CC
Hampton	45 Mbps	JPEG	9	CNDEC	2008	Central CC
Harvard	45 Mbps	JPEG	9	CNDEC	2008	Central CC
Hastings-Adams Central	45 Mbps	JPEG	9	CNDEC	2008	Central CC
Hastings-Central Community College	45 Mbps	JPEG				Central CC
Hastings-ESU 9	45 Mbps	JPEG	9	CNDEC	2008	Central CC
Kenesaw	45 Mbps	JPEG	9	CNDEC	2008	Central CC
Nelson-South Central Unified 5	45 Mbps	JPEG	9	CNDEC	2008	Central CC
Red Cloud	45 Mbps	JPEG	9	CNDEC	2008	Central CC
Roseland-Silver Lake	45 Mbps	JPEG	9	CNDEC	2008	Central CC
Superior-South Central NE Unified 5	45 Mbps	JPEG	9	CNDEC	2008	Central CC
Sutton	45 Mbps	JPEG	9	CNDEC	2008	Central CC
Giltner (NO DL)	1.5 Mbps		9			Central CC
Hastings Senior High (NO DL)	11 Mbps		9			Central CC
Brainard-East Butler	45 Mbps	MPEG2	7	Crossroads	2012	Central CC
Columbus	45 Mbps	MPEG2	7	Crossroads	2012	Central CC
Columbus-Central Community College	45 Mbps	MPEG2	7			Central CC
Columbus-ESU 7	45 Mbps	MPEG2	7	Crossroads	2012	Central CC
Columbus-Lakeview	45 Mbps	MPEG2	7	Crossroads	2012	Central CC
David City	45 Mbps	MPEG2	7	Crossroads	2012	Central CC
Genoa-Twin River H.S.	1.5 Mbps		7			Central CC
Humphrey	45 Mbps	MPEG2	7	Crossroads	2012	Central CC
Osceola	45 Mbps	MPEG2	7	Crossroads	2012	Central CC
Polk-High Plains	45 Mbps	MPEG2	7	Crossroads	2012	Central CC
Rising City	45 Mbps	MPEG2	7	Crossroads	2012	Central CC
Schuyler Central	45 Mbps	MPEG2	7	Crossroads	2012	Central CC
Shelby	45 Mbps	MPEG2	7	Crossroads	2012	Central CC
Stromsburg-Cross County	45 Mbps	MPEG2	7	Crossroads	2012	Central CC
Allen	45 Mbps	JPEG	1	ENDLC	2009	Northeast CC
Ashland-Ashland/Greenwood	45 Mbps	JPEG	2	ENDLC	2009	Southeast CC
Bancroft-Bancroft/Rosalie	45 Mbps	JPEG	2	ENDLC	2009	Northeast CC
Cedar Bluffs	45 Mbps	JPEG	2	ENDLC	2009	Southeast CC
Clarkson	45 Mbps	JPEG	7	ENDLC	2009	Central CC
Coleridge	45 Mbps	JPEG	1	ENDLC	2009	Northeast CC
Crofton	45 Mbps	JPEG	1	ENDLC	2009	Northeast CC
Dodge	45 Mbps	JPEG	2	ENDLC	2009	Metro CC
Emerson-Emerson/Hubbard	3 Mbps	H.264	1	ENDLC	2009	Northeast CC
Fremont (NO DL)	1.5 Mbps		2	ENDLC	2009	Metro CC
Fremont-ESU 2	45 Mbps	JPEG	2	ENDLC	2009	Southeast CC
Hartington	45 Mbps	JPEG	1	ENDLC	2009	Northeast CC
Homer	3 Mbps	H.264	1	ENDLC	2009	Northeast CC
Hooper-Logan View	45 Mbps	JPEG	2	ENDLC	2009	Metro CC
Howells	45 Mbps	JPEG	7	ENDLC	2009	Central CC
Laurel-Laurel/Concord	45 Mbps	JPEG	1	ENDLC	2009	Northeast CC
Leigh	45 Mbps	JPEG	2	ENDLC	2009	Central CC
Lyons-Lyons/Decatur Northeast	45 Mbps	JPEG	2	ENDLC	2009	Northeast CC
Macy-Umo n ho n Nation	45 Mbps	JPEG	1	ENDLC	2009	Northeast CC
Mead	45 Mbps	JPEG	2	ENDLC	2009	Southeast CC
Newcastle	45 Mbps	JPEG	1	ENDLC	2009	Northeast CC
North Bend	45 Mbps	JPEG	2	ENDLC	2009	Metro CC

Oakland-Oakland/Craig	45 Mbps	JPEG	2	ENDLC	2009	Northeast CC
Omaha-Metropolitan Community College	45 Mbps	JPEG				Metro CC
Pender	45 Mbps	JPEG	1	ENDLC	2009	Northeast CC
Prague	45 Mbps	JPEG	2	ENDLC	2009	Southeast CC
Raymond-Raymond Central	45 Mbps	JPEG	2	ENDLC	2009	Southeast CC
Scribner-Scribner/Snyder	45 Mbps	JPEG	2	ENDLC	2009	Metro CC
South Sioux City	45 Mbps	JPEG	1	ENDLC	2009	Northeast CC
Tekamah-Tekamah/Herman	45 Mbps	JPEG	2	ENDLC	2009	Northeast CC
Wahoo	45 Mbps	JPEG	2	ENDLC	2009	Southeast CC
Wakefield	45 Mbps	JPEG	1	ENDLC	2009	Northeast CC
Wakefield-ESU 1	45 Mbps	JPEG	1	ENDLC	2009	Northeast CC
Walthill	45 Mbps	JPEG	1	ENDLC	2009	Northeast CC
Wayne	45 Mbps	JPEG	1	ENDLC	2009	Northeast CC
West Point	45 Mbps	JPEG	2	ENDLC	2009	Northeast CC
Winnebago	45 Mbps	JPEG	1	ENDLC	2009	Northeast CC
Winside	45 Mbps	JPEG	1	ENDLC	2009	Northeast CC
Wisner-Wisner/Pilger	45 Mbps	JPEG	2	ENDLC	2009	Metro CC
Wynot	45 Mbps	JPEG	1	ENDLC	2009	Northeast CC
Yutan	45 Mbps	JPEG	2	ENDLC	2009	Southeast CC
Ponca (NO DL)	1.5 Mbps		1			Northeast CC
Lincoln-Bryan Learning Community	1000 Mbps	H.264	18	LDLC	2014	Southeast CC
Lincoln-East H.S.	1000 Mbps	H.264	18	LDLC	2014	Southeast CC
Lincoln-Lincoln H.S.	1000 Mbps	H.264	18	LDLC	2014	Southeast CC
Lincoln-LPSDO	1000 Mbps	H.264	18	LDLC	2014	Southeast CC
Lincoln-Northeast H.S.	1000 Mbps	H.264	18	LDLC	2014	Southeast CC
Lincoln-North Star H.S.	1000 Mbps	H.264	18	LDLC	2014	Southeast CC
Lincoln-Southeast H.S.	1000 Mbps	H.264	18	LDLC	2014	Southeast CC
Lincoln-Southwest H.S.	1000 Mbps	H.264	18	LDLC	2014	Southeast CC
Lincoln-Science Focus School	1000 Mbps	H.264	18	LDLC	2014	Southeast CC
Atkinson-West Holt Rural H.S.	45 Mbps	JPEG	8	NVTP	2006	Northeast CC
Bartlett-Wheeler Central	45 Mbps	JPEG	8	NVTP	2006	Northeast CC
Butte-West Boyd Unified	45 Mbps	JPEG	8	NVTP	2006	Northeast CC
Chambers	45 Mbps	JPEG	8	NVTP	2006	Northeast CC
Clearwater-NE Unified District 1	45 Mbps	JPEG	8	NVTP	2006	Northeast CC
Elgin	45 Mbps	JPEG	8	NVTP	2006	Northeast CC
Ewing	45 Mbps	JPEG	8	NVTP	2006	Northeast CC
Lynch	45 Mbps	JPEG	8	NVTP	2006	Northeast CC
Neligh-ESU 8	45 Mbps	JPEG	8	NVTP	2006	Northeast CC
O'Neill	45 Mbps	JPEG	8	NVTP	2006	Northeast CC
Orchard-NE Unified District 1	45 Mbps	JPEG	8	NVTP	2006	Northeast CC
Petersburg-Boone Central (nonrenewal?)	45 Mbps	JPEG	8	NVTP	2006	Northeast CC
Spencer-West Boyd Unified	45 Mbps	JPEG	8	NVTP	2006	Northeast CC
Stuart	45 Mbps	JPEG	8	NVTP	2006	Northeast CC
Ainsworth	45 Mbps	JPEG	17	NCDLC	2008	Northeast CC
Ainsworth-ESU 17	45 Mbps	JPEG	17	NCDLC	2008	Northeast CC
Bassett-Rock County H.S.	45 Mbps	JPEG	17	NCDLC	2008	Northeast CC
Cody-Cody/Kilgore	45 Mbps	JPEG	17	NCDLC	2008	Mid-Plains CC
Springview-Keya Paha	45 Mbps	JPEG	17	NCDLC	2008	Northeast CC
Valentine	45 Mbps	JPEG	17	NCDLC	2008	Mid-Plains CC
Bloomfield	45 Mbps	JPEG	1	NE.NEDLC	2007	Northeast CC
Creighton	45 Mbps	JPEG	1	NE.NEDLC	2007	Northeast CC
Niobrara	45 Mbps	JPEG	1	NE.NEDLC	2007	Northeast CC
Osmond	45 Mbps	JPEG	8	NE.NEDLC	2007	Northeast CC
Plainview	45 Mbps	JPEG	8	NE.NEDLC	2007	Northeast CC
Randolph	45 Mbps	JPEG	1	NE.NEDLC	2007	Northeast CC
Santee	45 Mbps	JPEG	1	NE.NEDLC	2007	Northeast CC
Verdigre-NE Unified District 1	45 Mbps	JPEG	1	NE.NEDLC	2007	Northeast CC

Wausa	45 Mbps	JPEG	1	NE.NEDLC	2007	Northeast CC
Albion-*Boone Central (unconsolidating?)*	45 Mbps	JPEG	7	NE. NELA	2007	Central CC
Battle Creek	45 Mbps	JPEG	8	NE. NELA	2007	Northeast CC
Madison	45 Mbps	JPEG	8	NE. NELA	2007	Northeast CC
Neligh-Neligh/Oakdale	45 Mbps	JPEG	8	NE. NELA	2007	Northeast CC
Newman Grove	45 Mbps	JPEG	8	NE. NELA	2007	Northeast CC
Norfolk-Northeast Community College	45 Mbps	JPEG			2007	Northeast CC
Norfolk-Northeast Community College	45 Mbps	JPEG			2007	Northeast CC
Norfolk-Northeast Community College	45 Mbps	JPEG			2007	Northeast CC
Norfolk-Northeast Nebraska Arts Council	45 Mbps	JPEG			2007	Northeast CC
Norfolk	45 Mbps	JPEG	8	NE. NELA	2007	Northeast CC
Pierce	45 Mbps	JPEG	8	NE. NELA	2007	Northeast CC
Stanton	45 Mbps	JPEG	8	NE. NELA	2007	Northeast CC
Tilden-Elkhorn Valley	45 Mbps	JPEG	8	NE. NELA	2007	Northeast CC
Wayne-Wayne State College	45 Mbps	JPEG			2007	
Wayne-Wayne State College	45 Mbps	JPEG			2007	
Ansley	45 Mbps	MPEG2	10	STEP	2012	Mid-Plains CC
Arcadia	45 Mbps	MPEG2	10	STEP	2012	Central CC
Broken Bow	45 Mbps	MPEG2	10	STEP	2012	Mid-Plains CC
Burwell	45 Mbps	MPEG2	10	STEP	2012	Northeast CC
Dunning	45 Mbps	MPEG2	10	STEP	2012	Mid-Plains CC
Loup City	45 Mbps	MPEG2	10	STEP	2012	Central CC
Merna-Anselmo/Merna	45 Mbps	MPEG2	10	STEP	2012	Mid-Plains CC
Sargent	45 Mbps	MPEG2	10	STEP	2012	Mid-Plains CC
Taylor-Loup County H.S.	45 Mbps	MPEG2	10	STEP	2012	Mid-Plains CC
Adams-Freeman H.S.	100 Mbps	H.264	5	SE.NEDLC	2011	Southeast CC
Arlington	100 Mbps	H.264	3	SE.NEDLC	2011	Metro CC
Auburn-ESU 4	100 Mbps	H.264	4	SE.NEDLC	2011	Southeast CC
Beatrice	100 Mbps	H.264	5	SE.NEDLC	2011	Southeast CC
Beatrice-ESU 5	100 Mbps	H.264	5	SE.NEDLC	2011	Southeast CC
Beatrice-Homestead National Monument	100 Mbps	H.264			2011	Southeast CC
Beatrice-Southeast Community College	100 Mbps	H.264			2011	Southeast CC
Bennington	100 Mbps	H.264	3	SE.NEDLC	2011	Metro CC
Blair	100 Mbps	H.264	3	SE.NEDLC	2011	Metro CC
Bruning-Bruning/Davenport H.S.	100 Mbps	H.264	5	SE.NEDLC	2011	Southeast CC
Chester-Thayer Central M.S.	100 Mbps	H.264	5	SE.NEDLC	2011	Southeast CC
Cook-Nemaha Valley	100 Mbps	H.264	4	SE.NEDLC	2011	Southeast CC
Crete	100 Mbps	H.264	6	SE.NEDLC	2011	Southeast CC
Davenport-Bruning/Davenport M.S.	100 Mbps	H.264	5	SE.NEDLC	2011	Southeast CC
Dawson-Dawson/Verdon	100 Mbps	H.264	4	SE.NEDLC	2011	Southeast CC
Daykin-Meridian	100 Mbps	H.264	5	SE.NEDLC	2011	Southeast CC
DeWitt-TriCounty	100 Mbps	H.264	5	SE.NEDLC	2011	Southeast CC
Deshler	100 Mbps	H.264	5	SE.NEDLC	2011	Southeast CC
Dorchester	100 Mbps	H.264	6	SE.NEDLC	2011	Southeast CC
Elkhorn	100 Mbps	H.264	3	SE.NEDLC	2011	Metro CC
Exeter-Exeter/Milligan H.S.	100 Mbps	H.264	6	SE.NEDLC	2011	Southeast CC
Fairbury	100 Mbps	H.264	5	SE.NEDLC	2011	Southeast CC
Fairmont-Fillmore Central M.S.	100 Mbps	H.264	6	SE.NEDLC	2011	Southeast CC
Falls City	100 Mbps	H.264	4	SE.NEDLC	2011	Southeast CC
Firth-Norris	100 Mbps	H.264	6	SE.NEDLC	2011	Southeast CC
Friend	100 Mbps	H.264	6	SE.NEDLC	2011	Southeast CC
Geneva-Fillmore Central H.S.	100 Mbps	H.264	6	SE.NEDLC	2011	Southeast CC
Gretna	100 Mbps	H.264	3	SE.NEDLC	2011	Metro CC
Hebron-Thayer Central H.S.	100 Mbps	H.264	5	SE.NEDLC	2011	Southeast CC
Henderson-Heartland	100 Mbps	H.264	6	SE.NEDLC	2011	Southeast CC
Humboldt-Humboldt/Table Rock/Steinauer	100 Mbps	H.264	4	SE.NEDLC	2011	Southeast CC
Johnson-Johnson/Brock	100 Mbps	H.264	4	SE.NEDLC	2011	Southeast CC
Lewiston	100 Mbps	H.264	4	SE.NEDLC	2011	Southeast CC

Site	Bandwidth	Codec				Year	College
Lincoln-NDE	100 Mbps	H.264				2011	
Lincoln-Southeast Community College	100 Mbps	H.264				2011	Southeast CC
Louisville	100 Mbps	H.264	3		SE.NEDLC	2011	Metro CC
Malcolm	100 Mbps	H.264	6		SE.NEDLC	2011	Southeast CC
McCool Junction	100 Mbps	H.264	6		SE.NEDLC	2011	Southeast CC
Milford	100 Mbps	H.264	6		SE.NEDLC	2011	Southeast CC
Milford-ESU 6	100 Mbps	H.264	6		SE.NEDLC	2011	Southeast CC
Milford-Southeast Community College	100 Mbps	H.264				2011	Southeast CC
Murdock-Elmwood/Murdock	100 Mbps	H.264	3		SE.NEDLC	2011	Metro CC
Murray-Conestoga	100 Mbps	H.264	3		SE.NEDLC	2011	Metro CC
Nebraska City	100 Mbps	H.264	4		SE.NEDLC	2011	Southeast CC
Nebraska City-Visually Impaired	100 Mbps	H.264	4		SE.NEDLC	2011	Southeast CC
Odell-Diller/Odell Secondary	100 Mbps	H.264	5		SE.NEDLC	2011	Southeast CC
Omaha-ESU 3	100 Mbps	H.264	3		SE.NEDLC	2011	Metro CC
Omaha-Henry Doorly Zoo	100 Mbps	H.264					Metro CC
Omaha-Millard North	100 Mbps	H.264	3		SE.NEDLC	2011	Metro CC
Omaha-Millard South	100 Mbps	H.264	3		SE.NEDLC	2011	Metro CC
Omaha-Millard West	100 Mbps	H.264	3		SE.NEDLC	2011	Metro CC
Omaha-Westside Dist. 66	100 Mbps	H.264	3		SE.NEDLC	2011	Metro CC
Palmyra	100 Mbps	H.264	4		SE.NEDLC	2011	Southeast CC
Pawnee City	100 Mbps	H.264	4		SE.NEDLC	2011	Southeast CC
Plattsmouth	100 Mbps	H.264	3		SE.NEDLC	2011	Metro CC
Seward	100 Mbps	H.264	6		SE.NEDLC	2011	Southeast CC
Shickley	100 Mbps	H.264	6		SE.NEDLC	2011	Southeast CC
Stella-SE Consolidated	100 Mbps	H.264	4		SE.NEDLC	2011	Southeast CC
Sterling	100 Mbps	H.264	4		SE.NEDLC	2011	Southeast CC
Syracuse-Syracuse/Dunbar/Avoca	100 Mbps	H.264	4		SE.NEDLC	2011	Southeast CC
Tecumseh	100 Mbps	H.264	4		SE.NEDLC	2011	Southeast CC
Utica-Centennial	100 Mbps	H.264	6		SE.NEDLC	2011	Southeast CC
Valley-Waterloo/Valley	100 Mbps	H.264	3		SE.NEDLC	2011	Metro CC
Waterloo-Waterloo/Valley	100 Mbps	H.264	3		SE.NEDLC	2011	Metro CC
Waverly	100 Mbps	H.264	6		SE.NEDLC	2011	Southeast CC
Weeping Water	100 Mbps	H.264	3		SE.NEDLC	2011	Southeast CC
Wilber-Clatonia	100 Mbps	H.264	6		SE.NEDLC	2011	Southeast CC
Wymore-Southern H.S.	100 Mbps	H.264	5		SE.NEDLC	2011	Southeast CC
York	100 Mbps	H.264	6		SE.NEDLC	2011	Southeast CC
Auburn (NO DL)	1.5 Mbps		4				Southeast CC
Bellevue East (NO DL)	1.5 Mbps		3				Metro CC
Bellevue West (NO DL)	1.5 Mbps		3				Metro CC
Fort Calhoun (NO DL)	1.5 Mbps		3				Metro CC
Omaha Benson (NO DL)	3.0 Mbps		19				Metro CC
Omaha Bryan (NO DL)	3.0 Mbps		19				Metro CC
Omaha Burke (NO DL)	3.0 Mbps		19				Metro CC
Omaha Central (NO DL)	3.0 Mbps		19				Metro CC
Omaha North (NO DL)	3.0 Mbps		19				Metro CC
Omaha Northwest (NO DL)	3.0 Mbps		19				Metro CC
Omaha South (NO DL)	3.0 Mbps		19				Metro CC
Papillion-LaVista (NO DL)	100 Mbps		3		SE.NEDLC	2009	Metro CC
Papillion-LaVista-South (NO DL)	4.5 Mbps		3				Metro CC
Ralston (NO DL)	100 Mbps		3		SE.NEDLC	2009	Metro CC
Springfield-South Darpy Dist. 46 (NO DL)	1.5 Mbps		3				Metro CC
Arapahoe	45 Mbps	JPEG	11		SW.NEDLC	2006	Central CC
Arnold	45 Mbps	JPEG	10		SW.NEDLC	2006	Mid-Plains CC
Arthur-Arthur County H.S.	45 Mbps	JPEG	16		SW.NEDLC	2006	Mid-Plains CC
Bartley-Southwest Public Schools	45 Mbps	JPEG	15		SW.NEDLC	2006	Mid-Plains CC
Benkelman-Dundy County H.S.	45 Mbps	JPEG	15		SW.NEDLC	2006	Mid-Plains CC
Brady	45 Mbps	JPEG	16		SW.NEDLC	2006	Mid-Plains CC
Callaway	45 Mbps	JPEG	10		SW.NEDLC	2006	Mid-Plains CC

Cambridge	45 Mbps	JPEG	11	SW.NEDLC	2006	Central CC
Culbertson-Hitchcock Co Unified	45 Mbps	JPEG	15	SW.NEDLC	2006	Mid-Plains CC
Curtis-Medicine Valley	45 Mbps	JPEG	15	SW.NEDLC	2006	Mid-Plains CC
Curtis-NE College of Tech Ag	45 Mbps	JPEG				
Eustis-Eustis/Farnam	45 Mbps	JPEG	11	SW.NEDLC	2006	Mid-Plains CC
Grant	45 Mbps	JPEG	16	SW.NEDLC	2006	Mid-Plains CC
Hayes Center	45 Mbps	JPEG	15	SW.NEDLC	2006	Mid-Plains CC
Hershey	45 Mbps	JPEG	16	SW.NEDLC	2006	Mid-Plains CC
Hyannis	45 Mbps	JPEG	16	SW.NEDLC	2006	Western CC
Imperial-Chase County H.S.	45 Mbps	JPEG	15	SW.NEDLC	2006	Mid-Plains CC
Indianola-Southwest Public Schools	45 Mbps	JPEG	15	SW.NEDLC	2006	Mid-Plains CC
Madrid-Wheatland	45 Mbps	JPEG	16	SW.NEDLC	2006	Mid-Plains CC
Maxwell	45 Mbps	JPEG	16	SW.NEDLC	2006	Mid-Plains CC
Maywood	45 Mbps	JPEG	15	SW.NEDLC	2006	Mid-Plains CC
McCook	45 Mbps	JPEG	15	SW.NEDLC	2006	Mid-Plains CC
McCook-MidPlainsCC	45 Mbps	JPEG				Mid-Plains CC
McCook-MidPlainsCC	45 Mbps	JPEG				Mid-Plains CC
Mullen	45 Mbps	JPEG	16	SW.NEDLC	2006	Mid-Plains CC
North Platte	45 Mbps	JPEG	16	SW.NEDLC	2006	Mid-Plains CC
North Platte-ESU 16	45 Mbps	JPEG	16	SW.NEDLC	2006	Mid-Plains CC
North Platte-MidPlains CC	45 Mbps	JPEG				Mid-Plains CC
North Platte-MidPlains CC	45 Mbps	JPEG				Mid-Plains CC
North Platte-UN West Central Research	45 Mbps	JPEG				
Ogallala	45 Mbps	JPEG	16	SW.NEDLC	2006	Mid-Plains CC
Ogallala-ESU 16	45 Mbps	JPEG	16	SW.NEDLC	2006	Mid-Plains CC
Oxford-Southern Valley	45 Mbps	JPEG	11	SW.NEDLC	2006	Central CC
Paxton-Consolidated	45 Mbps	JPEG	16	SW.NEDLC	2006	Mid-Plains CC
Stapleton	45 Mbps	JPEG	16	SW.NEDLC	2006	Mid-Plains CC
Sutherland	45 Mbps	JPEG	16	SW.NEDLC	2006	Mid-Plains CC
Thedford	45 Mbps	JPEG	16	SW.NEDLC	2006	Mid-Plains CC
Trenton-ESU 15	45 Mbps	JPEG	15	SW.NEDLC	2006	Mid-Plains CC
Trenton-Hitchcock Co. Unified	45 Mbps	JPEG	15	SW.NEDLC	2006	Mid-Plains CC
Tryon-McPherson County H.S.	45 Mbps	JPEG	16	SW.NEDLC	2006	Mid-Plains CC
Wallace	45 Mbps	JPEG	16	SW.NEDLC	2006	Mid-Plains CC
Wauneta-Wauneta/Palisade	45 Mbps	JPEG	15	SW.NEDLC	2006	Mid-Plains CC
Cedar Rapids	45 Mbps	JPEG	7	TVDEC-N	2009	Central CC
Elba	45 Mbps	JPEG	10	TVDEC-N	2009	Central CC
Clarks-High Plains Community M.S.	45 Mbps	JPEG	7	TVDEC-N	2009	Central CC
Columbus-ESU 7	45 Mbps	JPEG	7	TVDEC-N	2009	Central CC
Fullerton	45 Mbps	JPEG	7	TVDEC-N	2009	Central CC
Greeley-Greeley/Wolbach	45 Mbps	JPEG	10	TVDEC-N	2009	Central CC
Scotia-North Loup Scotia	45 Mbps	JPEG	10	TVDEC-N	2009	Central CC
Palmer	45 Mbps	JPEG	7	TVDEC-N	2009	Central CC
Spalding	45 Mbps	JPEG	10	TVDEC-N	2009	Central CC
St. Edward	45 Mbps	JPEG	7	TVDEC-N	2009	Central CC
Wolbach-Greeley/Wolbach	45 Mbps	JPEG	10	TVDEC-N	2009	Central CC
Alma	100 Mbps	H.264	11	TVDEC-S	2009	Central CC
Amherst	100 Mbps	H.264	10	TVDEC-S	2009	Central CC
Axtell	100 Mbps	H.264	11	TVDEC-S	2009	Central CC
Bertrand	100 Mbps	H.264	11	TVDEC-S	2009	Central CC
Cairo-Centura H.S.	100 Mbps	H.264	10	TVDEC-S	2009	Central CC
Cozad	100 Mbps	H.264	10	TVDEC-S	2009	Central CC
Elm Creek	100 Mbps	H.264	10	TVDEC-S	2009	Central CC
Elwood	100 Mbps	H.264	11	TVDEC-S	2009	Central CC
Franklin	100 Mbps	H.264	11	TVDEC-S	2009	Central CC
Gibbon	100 Mbps	H.264	10	TVDEC-S	2009	Central CC
Gothenburg	100 Mbps	H.264	10	TVDEC-S	2009	Central CC
Grand Island (NO DL)	1.5 Mbps		10			Central CC

Site	Bandwidth	Codec	ESU	DL System	Year	College
Grand Island-Central Community College	100 Mbps	H.264				Central CC
Hildreth-Wilcox/Hildreth	100 Mbps	H.264	11	TVDEC-S	2009	Central CC
Holdrege	100 Mbps	H.264	11	TVDEC-S	2009	Central CC
Holdrege-ESU 11	100 Mbps	H.264	11	TVDEC-S	2009	Central CC
Kearney	100 Mbps	H.264	10	TVDEC-S	2009	Central CC
Kearney-ESU 10	100 Mbps	H.264	10	TVDEC-S	2009	Central CC
Kearney-UN-Kearney	100 Mbps	H.264				
Lexington	100 Mbps	H.264	10	TVDEC-S	2009	Central CC
Litchfield	100 Mbps	H.264	10	TVDEC-S	2009	Central CC
Loomis	100 Mbps	H.264	11	TVDEC-S	2009	Central CC
Minden	100 Mbps	H.264	11	TVDEC-S	2009	Central CC
Ord	100 Mbps	H.264	10	TVDEC-S	2009	Central CC
Overton	100 Mbps	H.264	10	TVDEC-S	2009	Central CC
Pleasanton	100 Mbps	H.264	10	TVDEC-S	2009	Central CC
Ravenna	100 Mbps	H.264	10	TVDEC-S	2009	Central CC
Shelton	100 Mbps	H.264	10	TVDEC-S	2009	Central CC
St. Paul	100 Mbps	H.264	10	TVDEC-S	2009	Central CC
Sumner-Sumner/Eddyville/Miller H.S.	100 Mbps	H.264	10	TVDEC-S	2009	Central CC
Wilcox-Wilcox/Hildreth	100 Mbps	H.264	11	TVDEC-S	2009	Central CC
Grand Island NW (NO DL)	1.5 Mbps		10			Central CC
Wood River (NO DL)	1.5 Mbps		10			Central CC
Alliance	45 Mbps	JPEG	13	WNDLC	2009	Western CC
Bayard	45 Mbps	JPEG	13	WNDLC	2009	Western CC
Bridgeport	45 Mbps	JPEG	13	WNDLC	2009	Western CC
Chadron	45 Mbps	JPEG	13	WNDLC	2009	Western CC
Chadron-Chadron State College	45 Mbps	JPEG				Western CC
Chappell-Creek Valley	45 Mbps	JPEG	14	WNDLC	2009	Western CC
Crawford	45 Mbps	JPEG	13	WNDLC	2009	Western CC
Dalton-Leyton H.S.	45 Mbps	JPEG	14	WNDLC	2009	Western CC
Gering	45 Mbps	JPEG	13	WNDLC	2009	Western CC
Gordon	45 Mbps	JPEG	13	WNDLC	2009	Western CC
Harrisburg-Banner County H.S.	45 Mbps	JPEG	13	WNDLC	2009	Western CC
Harrison-Sioux County H.S.	45 Mbps	JPEG	13	WNDLC	2009	Western CC
Hay Springs	45 Mbps	JPEG	13	WNDLC	2009	Western CC
Hemingford	45 Mbps	JPEG	13	WNDLC	2009	Western CC
Kimball	45 Mbps	JPEG	14	WNDLC	2009	Western CC
Lodgepole-Creek Valley	45 Mbps	JPEG	14	WNDLC	2009	Western CC
Minatare	45 Mbps	JPEG	13	WNDLC	2009	Western CC
Mitchell	45 Mbps	JPEG	13	WNDLC	2009	Western CC
Morrill	45 Mbps	JPEG	13	WNDLC	2009	Western CC
Oshkosh-Garden County H.S.	45 Mbps	JPEG	14	WNDLC	2009	Western CC
Potter-Potter/Dix H.S.	45 Mbps	JPEG	14	WNDLC	2009	Western CC
Rushville	45 Mbps	JPEG	13	WNDLC	2009	Western CC
Scottsbluff	45 Mbps	JPEG	13	WNDLC	2009	Western CC
Scottsbluff-ESU 13	45 Mbps	JPEG	13	WNDLC	2009	Western CC
Scottsbluff-Western NE Community College	45 Mbps	JPEG				Western CC
Sidney-ESU 14	45 Mbps	JPEG	14	WNDLC	2009	Western CC
Sidney (NO DL)	1.5 Mbps		14			Western CC
Big Springs-South Platte H.S. (NO DL)	1.5 Mbps		14			Western CC

Summary Data

Number of H.S. with 45 Mbps JPEG	152
Number of H.S. with 45 Mbps MPEG2	20
Number of H.S. with 100 Mbps	97
Number of H.S. with 1.5-3.0 Mbps	23
Number of ESUs with 45 Mbps JPEG	11
Number of ESUs with 45 Mbps MPEG2	1
Number of ESUs with 100 or 1000 Mbps	6
Number of Hgher Ed/Informal Ed Sites	26	(17 JPEG, 1 MPEG2, 8 H.264)
	336

Consortium	Acronym	Contact	E-mail
Central Nebraska Distance Education Consortium	CNDEC	Chris Petroff	cpetroff@esu9.org
Crossroads Distance Education Consortium	Crossroads	Beth Kabes	bkabes@esu7.org
Eastern Nebraska Distance Learning Consortium	ENDLC	Diane Wolfe	dmwolfe@mail.esu2.org
Lincoln Distance Learning Consortium	LDLC	Kirk Langer	klanger@lps.org
Niobrara Valley TelePartnership	NVTP	Nigel Buss	nbuss@esu8.org
North Central Distance Learning Consortium	NCDLC	Nigel Buss	nbuss@esu8.org
Northeast Nebraska Distance Learning Consortium	NE.NEDLC	Nigel Buss	nbuss@esu8.org
Northeast Nebraska Learners Academy	NE. NELA	Nigel Buss	nbuss@esu8.org
Sandhills Technology Education Partnership	STEP	Rich Schlesselman	rschless@esu10.org
Southeast Nebraska Distance Learning Consortium	SE.NEDLC	Charles Doyle	cdoyle@esu5.org
Southwest Nebraska Distance Learning Consortium	SW.NEDLC	Shirley Schall	sschall@esu15.org
TriValleyDistance Education Consortium-N&S	TVDEC	John Stritt	jstritt@esu10.org
Western Nebraska Distance Learning Consortium	WNDLC	B.J. Peters	bpeters@esu13.org